

Symmetries via commutants: Where operator theory meets quantum dynamics

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Von Neumann's celebrated double-centraliser theorem completely characterises an operator algebra by its commutant (expressing the symmetries in the sense of Emmy Noether). We explain how symmetry-restrictions pertain to quantum dynamical systems.

Motivated by typical problems in quantum engineering (like controllability, observability, simulability and reachable sets), in the first part we illustrate how symmetry restrictions are reflected in numerical ranges and C -numerical ranges.

In the second part we take a general outlook and actually determine irreducible simple compact Lie algebras (i.e. subalgebras of $\mathfrak{u}(N)$ with fixed finite dimension N) just from the symmetries of their generating sets thus pushing earlier work [1-3] significantly forward.

The talk is based on joint work with Markus Wiener & Gunther Dirr (first part) and Emanuel Malvetti & Robert Zeier (for the second part).

- [1] R. Zeier and T. Schulte-Herbrüggen, *J. Math. Phys.* **52**, 113510 (2011).
- [2] Z. Zimborás, R. Zeier, T. Schulte-Herbrüggen, and D. Burgarth, *Phys. Rev. A* **92**, 042309 (2015).
- [3] R. Zeier and Z. Zimborás, *J. Math. Phys.* **56**, 081702 (2015)